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**U.S. Army Operation Enduring Freedom
Deployment Injury Surveillance Summary
1 January–31 December 2012
PHR No. S.0000614-12**

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June 2015



Executive Summary
Public Health Report No. S.0000614-12
U.S. Army Operation Enduring Freedom
Deployment Injury Surveillance Summary
1 January–31 December 2012

1 Purpose

The goals of this report on injuries to Soldiers engaged in Operation Enduring Freedom (OEF) are to—

- Describe the relative impact of injuries (battle and non-battle) compared to diseases for calendar year (CY) 2012.
- Document non-battle injury (NBI) rates and trends from 2003 to 2012.
- Identify leading causes and diagnoses of NBI for CY 2012.
- Summarize key U.S. Army Public Health Command (USAPHC) CY 2012 analytic deployment surveillance projects on injuries among deployed Soldiers.
- Make recommendations for the improvement of Army injury prevention based on data analyzed.

2 Conclusions/Findings

2.1 Routine Deployment Injury Surveillance Summary 2012, Army OEF

Routinely collected air evacuation, in-theater hospitalization, and casualty data provide the basis for deployment injury surveillance during Army deployments in support of OEF. NBI was notably the most significant cause of medical air evacuations. As in previous years, the proportion of air-evacuated NBIs was larger than that of battle injuries (BIs) and any other single category of disease. NBI was the second leading cause of OEF hospitalizations while BI was the first leading cause. Similar to previous reports, the leading causes of these NBIs indicate that many are likely preventable. Timely reporting of injury rates, types, and causes should allow commanders and Army leaders to focus their attention on prevention strategies and policies during ongoing operations.

2.2 Special Analytic Deployment Injury Surveillance Project Summaries, 2012

Since there are physical and mental demands that military training and operations require from Soldiers, it is important to evaluate and describe the leading types of injury and causes for NBIs.

The overall rate for injuries from sport and exercise was 6.7 per 10,000 deployed Soldier-years. The annual rate of sport and exercise injury-related musculoskeletal (MSK) conditions trended upward since the beginning of present conflicts.

Injuries related to combat load carriage or wear of the interceptor body armor (IBA) tend to be overuse injuries. Overuse injuries of the back comprised 49 percent of NBIs in OEF, but there is insufficient detail in medical records to determine the influence of load carriage.

3 Recommendations

Link additional data sources, such as levels IV and V hospitalizations and disability records, to provide an enhanced description of deployment injuries and their outcomes.

Continue investigations to identify potentially modifiable risk factors that contribute to the leading causes of injury.

Focus attention on strategies to prevent injuries from sports/physical training, falls/jumps, and land transport accidents.

Public Health Report No. S.0000614-12

**Epidemiology and Disease Surveillance Portfolio
Injury Prevention Program**

**Deployment Injury Surveillance Summary, U.S. Army Operation Enduring
Freedom, 2012**

Avni Patel
Bonnie Taylor
Keith Hauret
Bruce Jones

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1 January–31 December 2012

1 Summary

1.1 Purpose

The goals of this report on injuries to Soldiers engaged in Operation Enduring Freedom (OEF) are to—

- Describe the relative impact of injuries (battle and non-battle) compared to diseases for calendar year (CY) 2012.
- Document non-battle injury (NBI) rates and trends from 2003 to 2012.
- Identify leading causes and diagnoses of NBI for CY 2012.
- Summarize key U.S. Army Public Health Command (USAPHC) CY 2012 analytic deployment surveillance projects on injuries among deployed Soldiers.
- Make recommendations for the improvement of Army injury prevention based on data analyzed.

1.2 Conclusions

1.2.1 Routine Deployment Injury Surveillance Summary 2012, Army OEF

Routinely collected air evacuation, in-theater hospitalization, and casualty data provide the basis for deployment injury surveillance during Army deployments in support of OEF. NBI was notably the most significant cause of medical air evacuations. As in previous years, the proportion of air-evacuated NBIs was larger than that of battle injuries (BIs) and any other single category of disease. NBI was the second leading cause of OEF hospitalizations while BI was the first leading cause. Similar to previous reports, the leading causes of these NBIs indicate that many are likely preventable. Timely reporting of injury rates, types, and causes should allow commanders and Army leaders to focus their attention on prevention strategies and policies during ongoing operations.

1.2.2 Special Analytic Deployment Injury Surveillance Project Summaries, 2012

Since there are physical and mental demands that military training and operations require from soldiers, it is important to evaluate and describe the leading types of injury and causes for NBIs.

The overall rate for injuries from sport and exercise was 6.7 per 10,000 deployed soldier-years. The annual rate of sport and exercise injury-related musculoskeletal (MSK) conditions trended upward since the beginning of present conflicts.

Injuries related to combat load carriage or wear of the interceptor body armor (IBA) tend to be overuse injuries. Overuse injuries of the back comprised 49 percent of NBIs in OEF, but there is insufficient detail in medical records to determine the influence of load carriage.

1.3 Recommendations

Link additional data sources, such as levels IV and V hospitalizations and disability records, to provide an enhanced description of deployment injuries and their outcomes.

Continue investigations to identify potentially modifiable risk factors that contribute to the leading causes of injury.

Focus attention on strategies to prevent injuries from sports/physical training, falls/jumps, and land transport accidents.

2 References

References are listed in Appendix A.

3 Authority

Army Regulation (AR) 40-5, *Preventive Medicine*, 25 May 2007; Section 2-19.

4 Background

Injuries are a major health problem confronting U.S. Military Forces in garrison and combat operations (references 1-2). For past conflicts, data on injuries were available only after the conflict. For more recent conflicts, there was timelier, on-going reporting of both BIs and NBIs. Operations in Iraq (Operations Iraqi Freedom (OIF) and New Dawn) came to an end in 2011 shifting the focus of this report to OEF primarily. For the present operations in Afghanistan, medically air evacuated NBIs have accounted for a larger proportion than BIs or any other individual disease diagnosis group (references 3-9). Previous deployment injury surveillance reports have provided injury rates and trends that were used to develop targeted prevention efforts for those injuries with the highest or increasing rates (references 8-11). To prevent injuries, knowledge of the causes of injuries is also needed. The data in this report are unique in that they identify the causes of BI and NBI. This report provides a foundation for setting deployment injury prevention priorities based on the magnitude, severity, and causes of injuries.

5 Methods

5.1 Population

This report describes BIs and NBIs among all deployed Army Soldiers (active duty, Reserve, and National Guard) in support of OEF from 1 January 2012 through 31 December 2012 that resulted in:

- Air evacuation from the Central Command (CENTCOM) area of responsibility (AOR),
- Hospitalization in the CENTCOM AOR, and/or
- Death.

5.2 Data Sources

5.2.1 Air-evacuated Injuries

Injury data for Soldiers air evacuated from CENTCOM were obtained from the U.S. Transportation Command's Regulating and Command & Control Evacuation System (TRAC²ES). These data were routinely collected and used to request and coordinate medical air evacuation of Service members with serious injuries and diseases.

5.2.2 Hospitalized Injuries

Standard Inpatient Data Records (SIDR) for hospitalizations in the CENTCOM AOR were obtained from the Patient Administration Systems and Biostatistics Activity (PASBA), a component of the Decision Support Center, Office of the Surgeon General. These electronic records were created from medical records that were forwarded to PASBA after Soldiers were hospitalized in CENTCOM. These SIDR records are the official electronic record of a hospitalization in a Department of Defense (DOD) medical facility.

5.2.3 Fatal Injuries

Data for the number and causes of NBI deaths, BI deaths, and for the number of deaths from disease were obtained from the Defense Casualty Information Processing System (DCIPS). These data were routinely collected and used for casualty tracking and mortuary affairs. DCIPS is maintained by the Army's Casualty and Memorial Affairs Operations Center, U.S. Army Human Resources Command.

5.3 Identification and Description of Injury Cases

5.3.1 Relative Importance of Injury and Disease

Primary Diagnosis Groups from the International Classification of Diseases, 9th Revision, Clinical Module (ICD-9-CM) and BI/NBI/Disease indicators were used to determine the relative importance of injuries (NBI and BI) and diseases among Soldiers who were air evacuated from CENTCOM or hospitalized in CENTCOM.

5.3.2 Exclusion Criteria

- A 60-day air evacuation exclusion rule was used to avoid double counting of injured Soldiers who were air evacuated from CENTCOM on more than one occasion for the same diagnosis within a 60-day timeframe of the initial event. This exclusion criterion was applied to all out-of-CENTCOM air evacuation movements.
- Similarly, a 30-day hospitalization exclusion rule was used so that multiple injury hospitalizations of a Soldier for the same diagnosis (3-digit ICD-9-CM code) within a 30-day timeframe of the initial event were represented as a single hospitalization in the analysis. This 30-day timeframe accounts for distinct injuries, considering that some injuries required multiple hospitalizations.
- Injuries that required air evacuation within CENTCOM only (that is, further evacuation from CENTCOM was not required) were excluded from the air evacuation analyses.

5.3.3 Injury Rate Calculations

Injury rates for NBIs and BIs were calculated in this report. An annual injury rate was determined by dividing the number of injured Soldiers for the year by the total number of deployed person-years for that year. Information for number of deployed persons per year was obtained from the Joint Chiefs of Staff, Manpower, and Personnel Directorate (reference 12).

5.3.4 Causes of Injury (NBIs and BIs)

- Air-evacuated Injuries. The intent (intentional and unintentional) and the causes of injury were identified from narrative patient histories in the air evacuation records. Trained coders used the North Atlantic Treaty Organization (NATO) Standardization Agreement (STANAG) No. 2050, 5th Edition (Military Agency for Standardization, 1989) coding scheme to categorize the causes of injury (reference 13).
- Hospitalized Injuries. The STANAG-coded causes of injury were already present in the in-CENTCOM hospitalization records (SIDR) from PASBA and were used to determine the intent and cause of injury.
- Fatal Injuries. Causes of fatal NBIs and BIs were identified from casualty reports in DCIPS records. As with the air evacuation records, trained coders used the STANAG coding scheme to categorize the cause of injury.

5.3.5 Type of Injury by Body Region Matrices for NBIs

- The NBIs were categorized into two subgroups: 1) acute traumatic injuries and 2) injury-related MSK conditions. A matrix was used to categorize the injuries in each of the NBI subgroups by injury type (e.g., fracture, dislocation, sprain/strain, and so forth) and body region.
- The modified Barell injury matrix (reference 14) was used to display injury frequencies for acute traumatic NBIs (ICD-9-CM codes 800-995; see Appendix B) in a standardized format in which the type of injury is listed horizontally, across the top of the table, and the body region is listed vertically, along the left side of the table. Two Barell matrices are shown in table 3 and 5; one includes only those NBIs that required out-of-CENTCOM air evacuation, and the other includes only those NBIs that required in-theater hospitalization.
- A similar matrix format was used to display the frequencies of injury-related MSK conditions (subset of ICD-9-CM codes 719-739; see Appendix C). Two MSK matrices are shown in table 4 and 6; one includes only those NBIs that required out-of-CENTCOM air evacuation, and the other includes only those NBIs that required in-theater hospitalization.

6 Results - Routine Deployment Injury Surveillance Summary, Army OEF, 2012

6.1 Distribution of Medical Air Evacuations by Primary Diagnosis Group, OEF

Figure 1 shows the percentage of injuries and disease by primary diagnosis groups (ICD-9-CM code) for OEF out-of-CENTCOM medical air evacuations in CY 2012.

- In CY 2012, 3,159 Soldiers were medically air-evacuated from OEF to out-of-CENTCOM medical facilities.
- NBIs accounted for 28 percent (n=885) of these OEF air evacuations. BI is the second leading cause of medical air evacuations (24 percent [n=760]). These proportions are considerably greater than that of the leading disease diagnosis group, mental health (19 percent [n=594]).
- The percentage of air evacuations for mental health (19 percent) is more than three times the percentage for the second leading specific disease category, digestive (5 percent [n=162]).

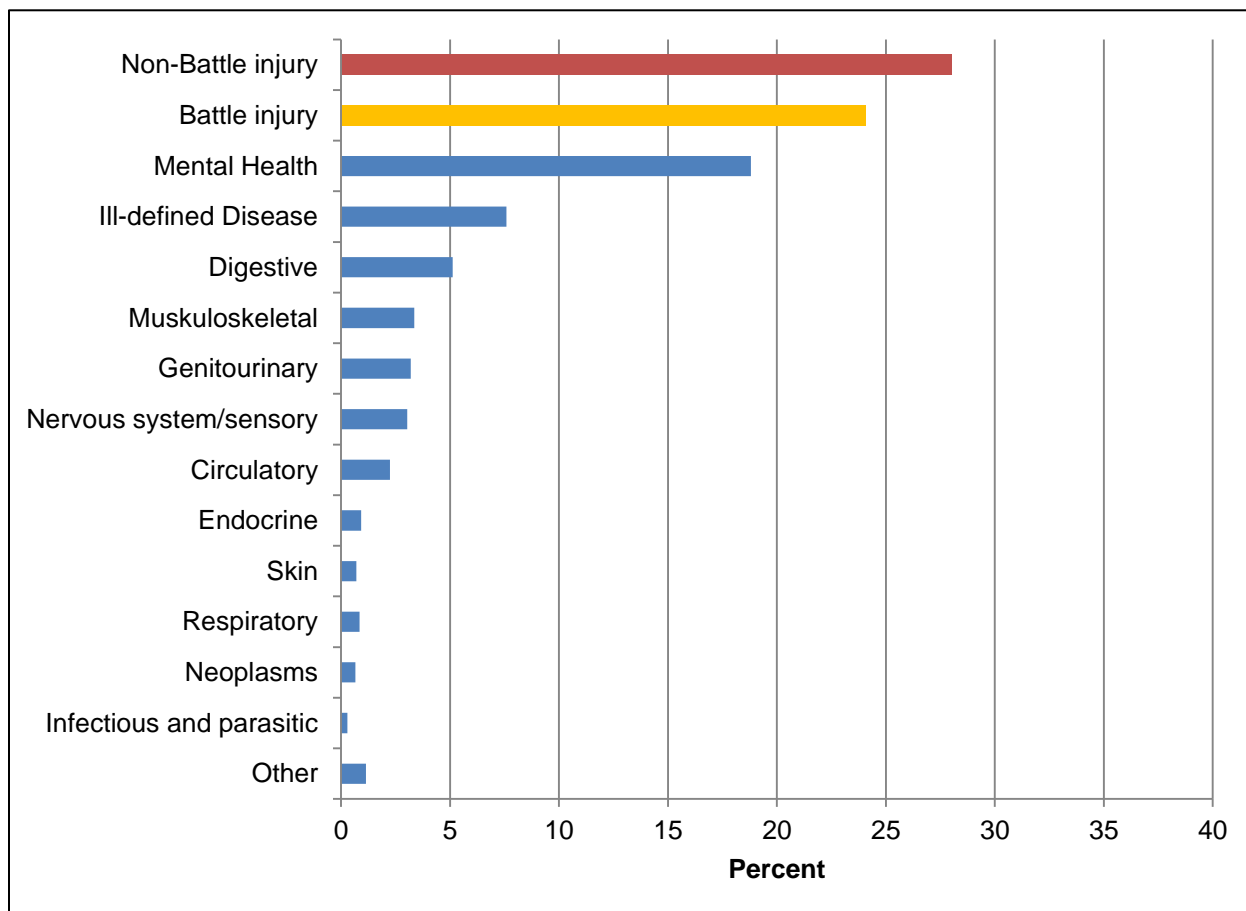


Figure 1. Distribution (Percentage) of Injury and Disease by Diagnosis Category among Air-evacuated U.S. Army Soldiers, OEF, CY 2012

Note: Includes injury and disease resulting in out-of-CENTCOM air evacuation for 3,159 Soldiers.

6.2 Distribution of In-theater Hospitalizations by Primary Diagnosis Group, OEF

Figure 2 shows the percentage of hospitalized injuries and diseases by primary diagnosis groups (ICD-9-CM code) for OEF in CY 2012.

- In CY 2012, there were 1,309 hospitalizations in CENTCOM for OEF.
- The combined BIs (40 percent) and NBIs (14 percent) accounted for 54 percent (n=698) of hospitalizations. The leading specific disease category was digestive disorders (12 percent [n=155]).
- The percentage of hospitalizations for BI was more than three times the leading specific disease category, digestive disorders, while the percentage of NBI is only 2 percent greater than the percentage for digestive disorders.

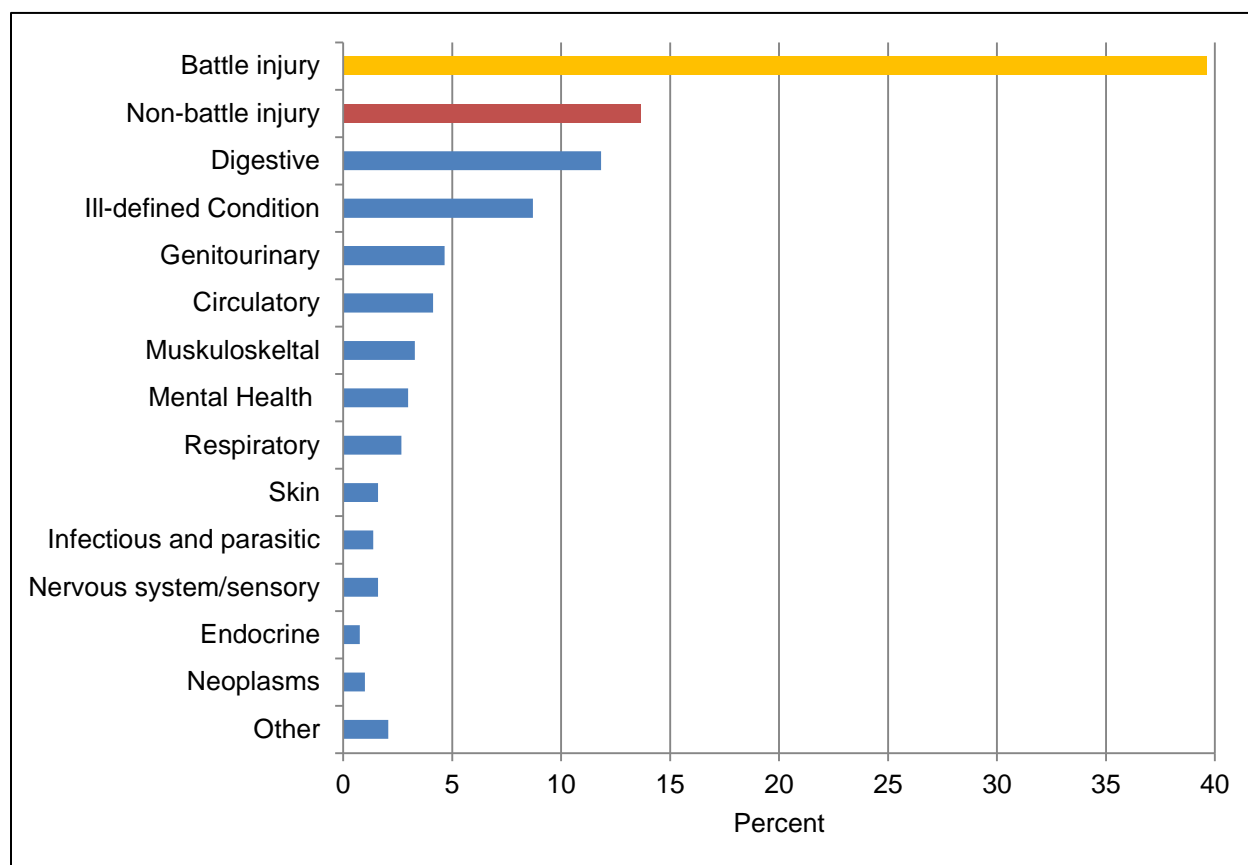


Figure 2. Distribution (Percentage) of Injury and Disease by Diagnosis Category among Hospitalized U.S. Army Soldiers, OEF, CY 2012

Note: Includes injury and disease resulting in in-CENTCOM hospitalization (N=1,309).

6.3 Distribution of Air Evacuations, Hospitalizations, and Deaths by Casualty Type, OEF

Table 1 summarizes OEF deployment injury and disease casualties in CY 2012.

- For every 1 NBI death in OEF in 2012, there were nearly 5 NBI hospitalizations and 24 NBI medical air evacuations.
- Conservatively assuming no overlap among BI air evacuations (n=760), hospitalizations (n=519), and deaths (n=176); at least 52 percent of these BIs (total n=1,455) resulted in out-of-CENTCOM air evacuations, 36 percent in in-theater hospitalization, and 12 percent in death.
- These data show that in OEF during CY 2012, there were far more non-fatal injuries that resulted in medical-air evacuation or hospitalization than fatal injuries. These non-fatal outcomes result in significant lost duty time and decreased operational readiness for the Army.

Table 1. Distribution of Battle Injury and NBI for Air Evacuations, Hospitalizations, and Death¹ among U.S. Army Soldiers Deployed for OEF, CY 2012

	Battle Injury		Non-Battle Injury ²	
	Number (n)	Row Percent (%)	Number (n)	Row Percent (%)
Air Evacuations (n=1,645)	760	46.2	885	53.8
Hospitalizations (n=698)	519	74.4	179	25.6
Deaths (n=213)	176	82.6	37	17.4

Notes:

¹Air evacuation, hospitalization, and death categories are not mutually exclusive.

²Includes acute injuries and injury-related musculoskeletal conditions.

6.4 NBI Rates, OEF

Figure 3 illustrates the annual NBI rates for air evacuations, hospitalizations, and deaths from 2003 through 2012.

- Despite the increases in 2006- 2007 and 2009-2010, the annual rates for air evacuated NBIs decreased overall from 29/1,000 person-years to 11/1,000 person-years between 2003 and 2012.
- From 2005 to 2010, the annual rates for hospitalized NBIs remained relatively constant at 6 to 7 per 1,000 person-years. However, a decrease from 2010 to 2012 was noted.

- The annual rates for NBI deaths remained consistently less than 2 deaths per 1,000 person-years, showing no significant change from 2003 through 2012.

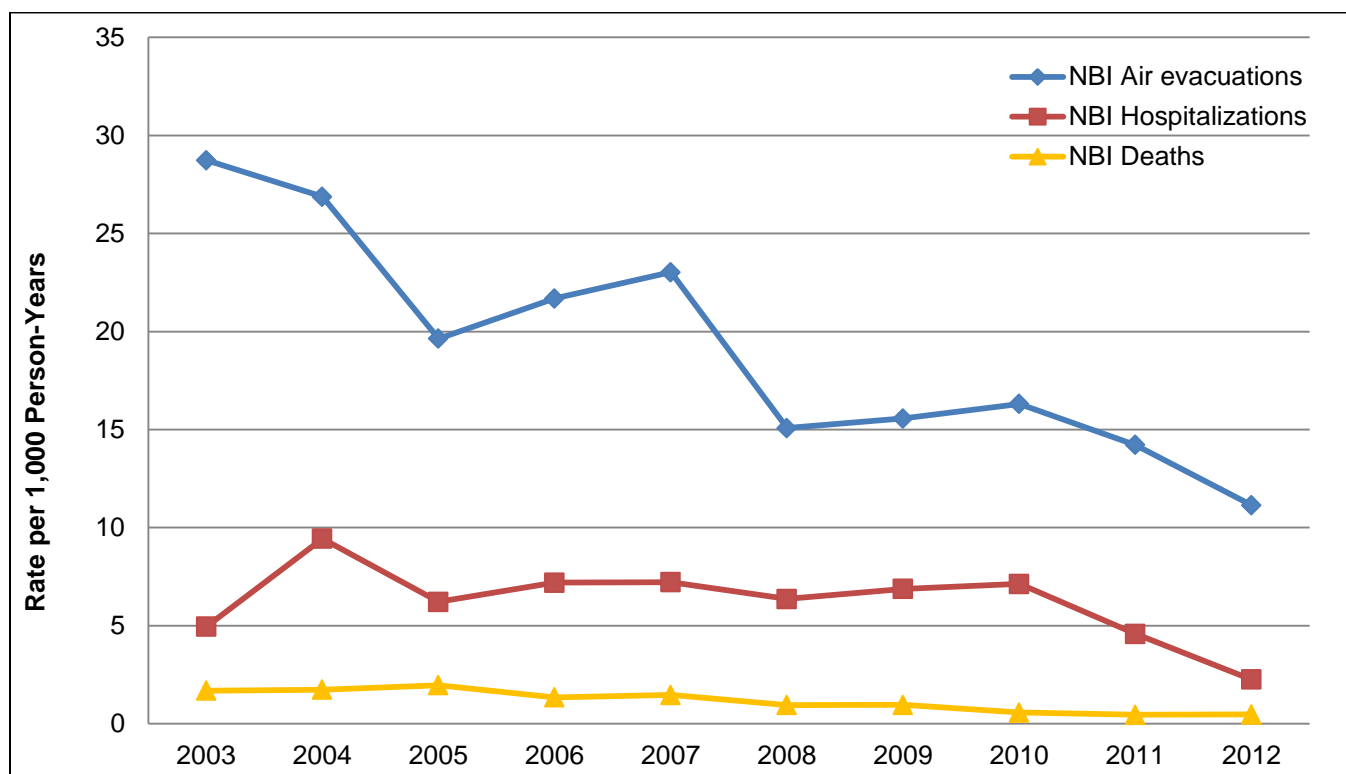


Figure 3. Annual NBI Rates among U.S. Army Soldiers Deployed for OEF, CYs 2003–2012

Note: Denominators for the rates were unclassified data obtained from the Joint Chiefs of Staff, Manpower and Personnel Directorate.

6.5 BI Rates, OEF

Figure 4 illustrates the annual BI rates for air evacuations, hospitalizations, and deaths from 2003 to 2012.

- After BI hospitalization increased from 2006 to 2009, both hospitalization and air evacuation rates greatly decreased in 2011 and 2012.
- Annual rates for BI deaths decreased from 2010 to 2012.
- The annual rates for BI deaths had increased steadily from 2003 to 5 deaths per 1,000 person-years in 2009, before decreasing slightly to 2 deaths per 1,000 person-years in 2012.

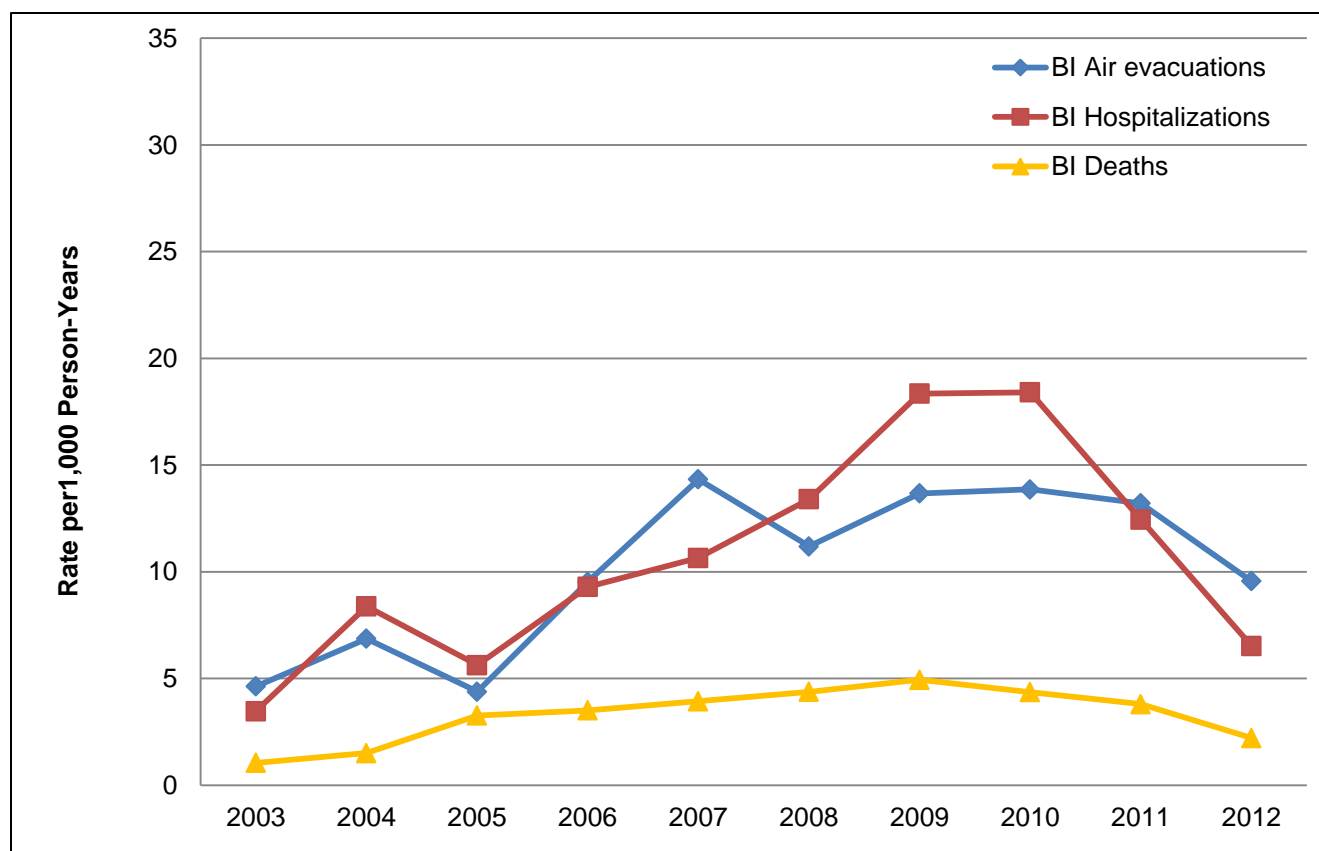


Figure 4. Annual Battle Injury Rates (Air Evacuations, Hospitalizations, and Deaths) among U.S. Army Soldiers Deployed for OEF, CY 2003–2012

Note: Denominators for the rates were unclassified data obtained from the Joint Chiefs of Staff, Manpower and Personnel Directorate.

6.6 Causes of BI Death, OEF, CY 2012

Figure 5 illustrates the distribution of causes of Army BI deaths in CY 2012.

- Fifty-nine percent of battle fatalities were due to explosive devices.
- Thirty-four percent of battle fatalities were due to small arms fire.
- Four percent of battle fatalities were due to rocket-propelled grenades.
- Two percent of battle fatalities were due to artillery, mortar, or rockets.

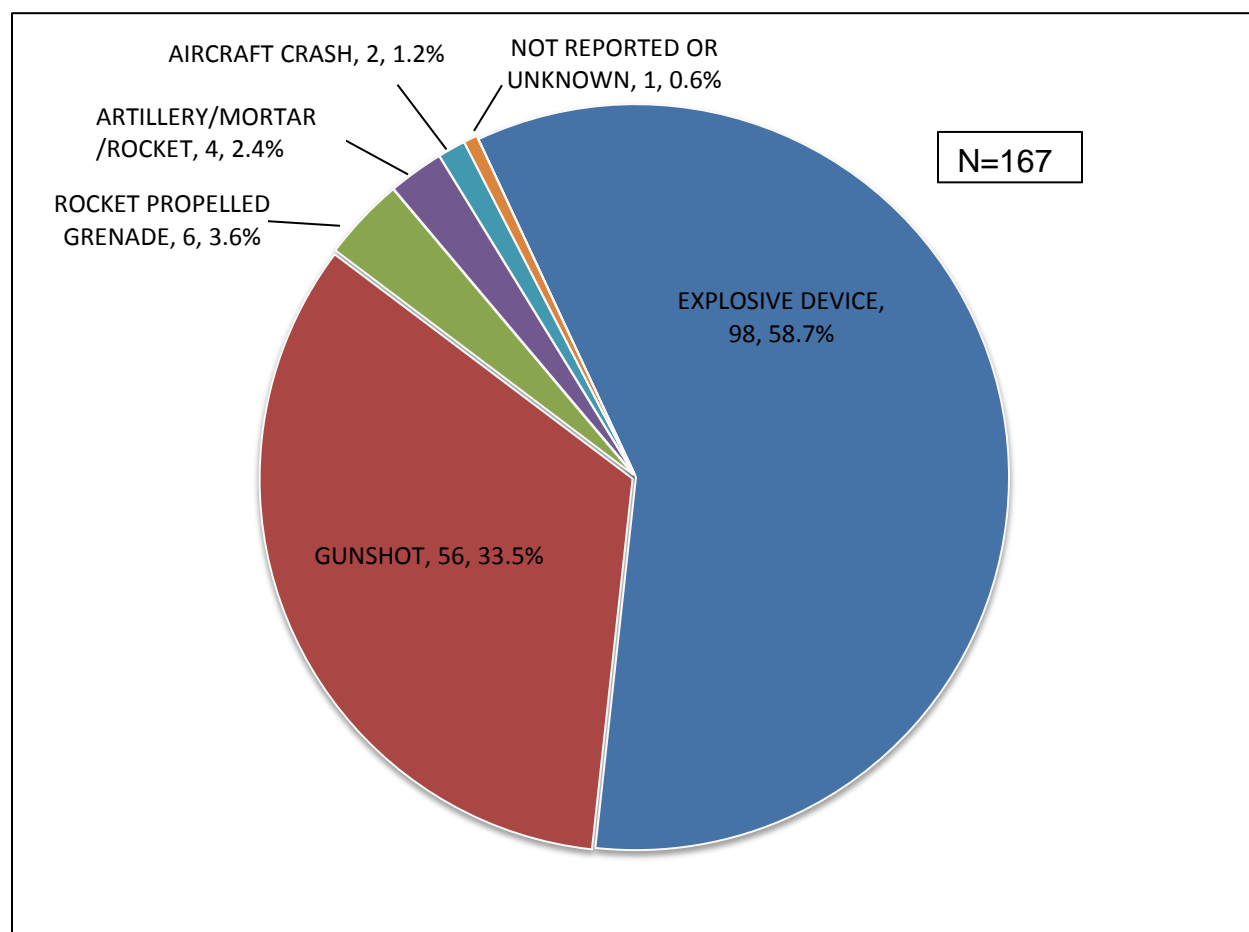


Figure 5. Distribution of Causes of Battle Injury Deaths (n, percent) among U.S. Army Soldiers Deployed for OEF, CY 2012

Note: Data obtained from Defense Casualty Information Processing System (DCIPS).

6.7 Injury Intent for NBI Air Evacuations, Hospitalizations, and Deaths, OEF, CY 2012

Table 2 provides a summary of CY 2012 OEF NBIs by injury intention.

- The majority of NBI air evacuations (99 percent) and hospitalizations (92 percent) were unintentional injuries. Of the fatal NBIs, 51 percent resulted from intentionally self-inflicted injuries.
- All of the self-inflicted NBI deaths (n=19) were from weapons-related incidents.
- Of the self-inflicted NBIs resulting in hospitalization (n=12), 75 percent were caused by inhalation or ingestion of toxic substances, 17 percent were cutting-related incidents, and 8 percent were weapons-related incidents.

- Of the self-inflicted NBIs resulting in air evacuation (n=4), 3 (75 percent) were caused by inhalation or ingestion of toxic.

Table 2. Injury Intent for NBI OEF, CY 2012

	OEF					
Injury Intention ¹	Air Evacuations		Hospitalizations		Deaths	
	n	%	n	%	n	%
Intentional						
Inflicted by another	2	0.2	1	0.6	0.0	0.0
Self-inflicted	4	0.5	12	6.7	19	51.3
Unintentional	879	99.3	164	91.6	18	48.7
Unknown	0.0	0.0	2	1.1	0.0	0.0
TOTAL	885	100.0	179	100	37	100.0

Note:

¹Intention of injury was determined by the STANAG 2050 trauma code.

6.8 Cause of Injury for Air Evacuated NBIs

Figure 6 illustrates the distribution of the leading causes of air evacuated NBIs, categorized by STANAG 2050 injury cause code groups.

- In 2012, the cause of injury was identified for 764 (86 percent) of the air evacuated NBIs from OEF.
- The four leading causes of air evacuated NBIs were sports/physical training, falls/jumps, crushing/blunt trauma, and twist/slip/trip.
- The leading causes of sports-related NBIs were weightlifting (26 percent), physical training (22 percent), basketball (21 percent), and American football (14 percent). (Note: These data examples are not shown in the figure.)

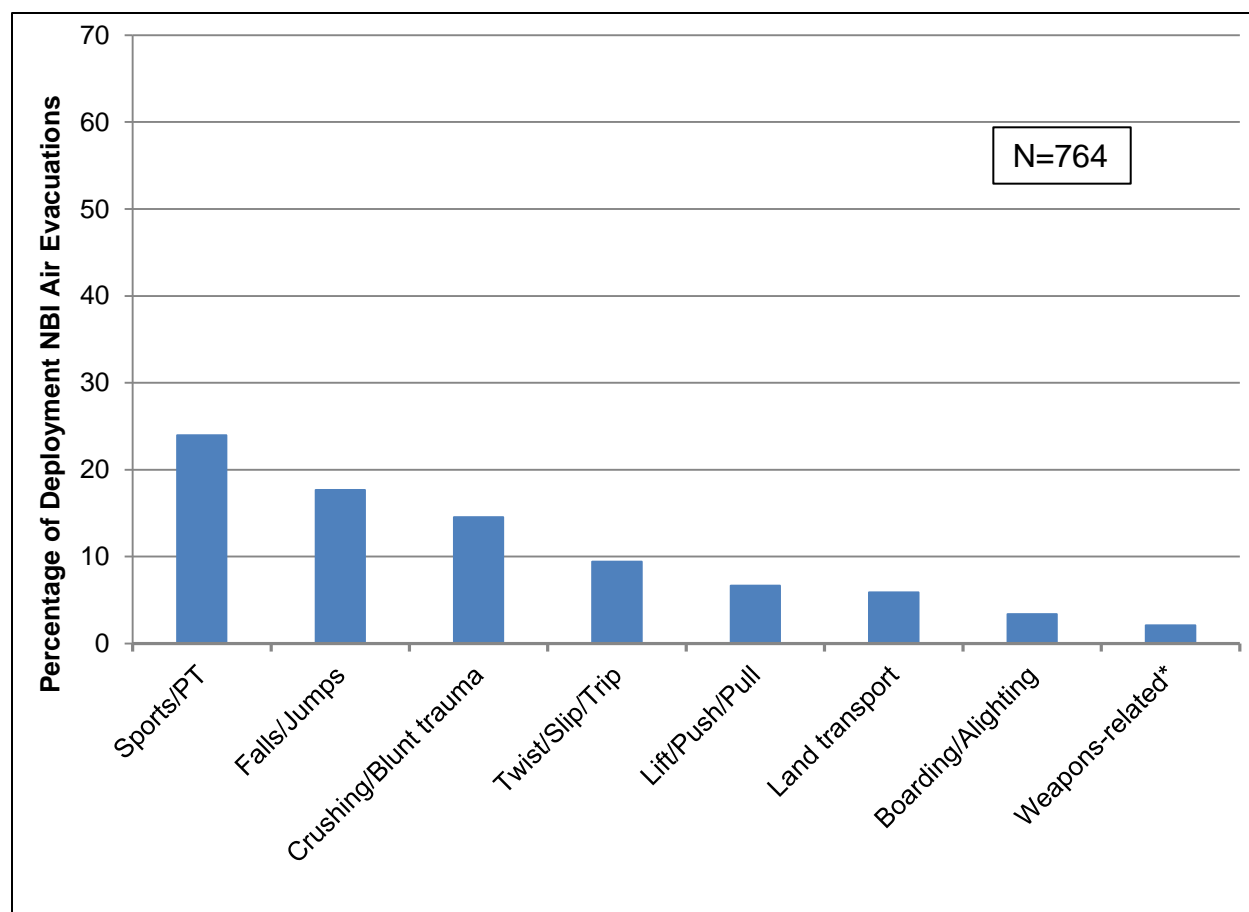


Figure 6. Distribution of Leading Causes¹ of Air Evacuated NBI among U.S. Army Soldiers Deployed for OEF, CY 2012

Notes:

¹Proportion of total 2012 deployment NBI air evacuations (OEF: N=885).

* "Weapons-related" injuries were referred to as "own weapon" and "handling weapons/explosives" in previous reports.

6.9 Causes of Injury for Hospitalized NBIs

Figure 7 illustrates the distribution of the leading causes of injury for hospitalized NBIs, categorized by STANAG 2050 injury cause code groups.

- In 2012, the cause of injury was identified for 172 (96 percent) of the hospitalized NBIs.
- The three leading causes of hospitalized NBIs were falls/jumps (17 percent), crushing/blunt trauma (12 percent), and land transport (12 percent).
- Fifty percent of falls/jumps were from falling from one level to another (these data examples are not shown on the figure).

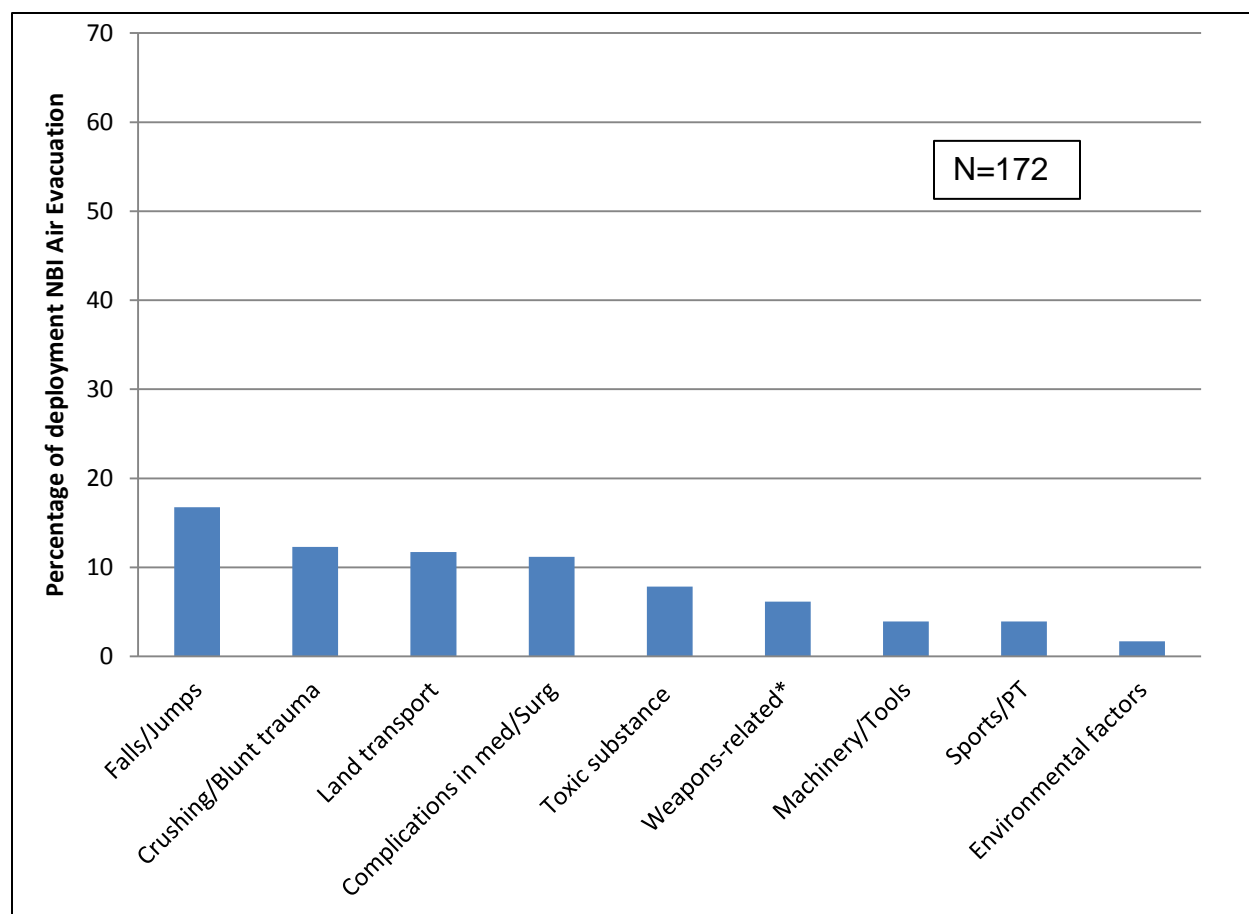


Figure 7. Distribution of Leading Causes¹ of Hospitalized NBIs among U.S. Army Soldiers Deployed for OEF, CY 2012

Notes:

¹Proportion of total 2012 deployment NBI hospitalizations (OEF: N=179).

* "Weapons-related" injuries were referred to as "own weapon" and "handling weapons/explosives" in previous reports.

6.10 Causes of NBI Deaths

Figure 8 illustrates the distribution of the leading NBI causes of NBI death as a proportion of total NBI deaths.

- The leading cause of NBI death was weapons-related (62 percent).
- Eighty-three percent of "weapons-related" deaths were intentionally self-inflicted (n=19) and 17 percent (n=4) were accidental (these data are not shown on the figure).
- Land transport, air transport, and inhalation or ingestion of toxic substances are each 11 percent of the NBI fatalities for OEF.

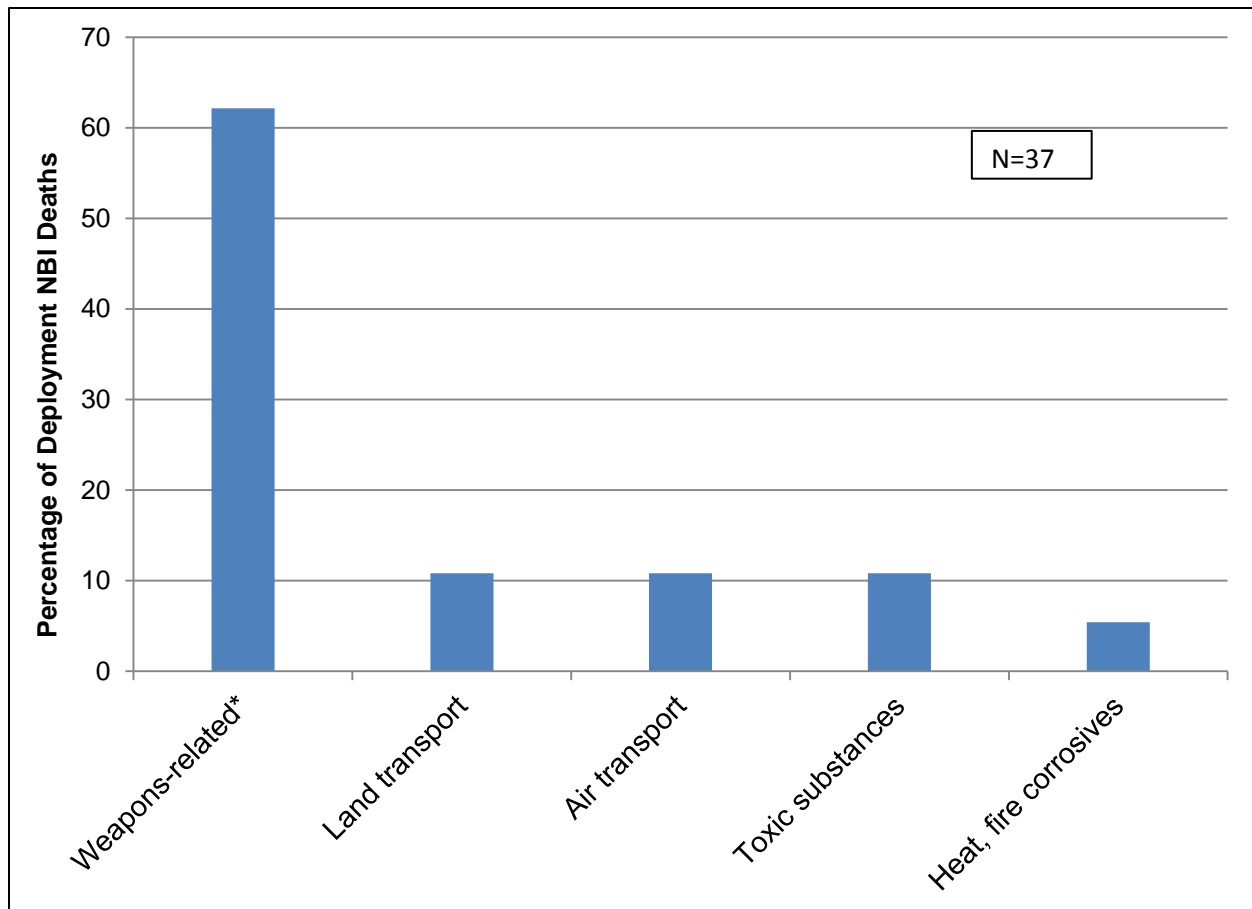


Figure 8. Distribution of Leading Causes¹ of NBI Deaths among U.S. Army Soldiers Deployed for OEF, CY 2012

Notes:

¹Cause of injury for deaths was obtained from DCIPS (OEF: N=37).

* "Weapons-related" injuries were referred to as "own weapon" and "handling weapons/explosives" in previous reports.

6.11 Frequency of Air Evacuated Traumatic NBIs by Injury Type and Location of Injury

Table 3 uses a modified Barell injury matrix to categorize, by injury type and body region, the traumatic NBIs that were air evacuated from OEF in CY 2012.

- In 2012, 540 acute/traumatic NBIs (coded in the 800-995 ICD-9-CM code series) required medical air evacuation.
- The most common types of acute/traumatic injury leading to medical air evacuation were fractures (46 percent), sprains/strains (17 percent), and dislocations (16 percent).

- By body region, acute/traumatic injuries primarily involved the upper extremity (41 percent) and lower extremity (39 percent).
- The leading injuries by type and location were fractures of the lower leg and/or ankle (15 percent), fractures of the wrist, hand, or fingers (13 percent), dislocation of the knee (9 percent), and strain/sprain of the shoulder/upper arm (6 percent).

6.12 Frequency of Air Evacuated NBI-related MSK Conditions by Type and Location of Injury

Table 4 categorizes, by type of injury and body region, the NBI-related MSK conditions (a subset of MSK conditions coded in the 719-739 ICD-9-CM series) that required medical air evacuation from OEF in CY 2012.

- In 2012, 251 NBI-related MSK conditions required medical air evacuation.
- The most common types of air evacuated MSK conditions were inflammation and pain (overuse) (58 percent), sprain/strain/rupture of muscle or tendons (16 percent), joint derangement (14 percent), and joint derangement with neurological involvement (8 percent).
- At 57 percent, the spine/back was the body region most affected by injury-related MSK conditions, followed by the lower extremities (19 percent), and upper extremities (17 percent).
- The leading specific injury-related MSK conditions were inflammation and pain (overuse) in the lower back (lumbar spine) (35 percent), inflammation and pain (overuse) in the shoulder (7 percent), and inflammation and pain (overuse) in the neck (cervical spine) (6 percent).

6.13 Frequency of Hospitalized Traumatic NBIs by Type and Location of Injury

Table 5 uses the modified Barrel injury matrix to categorize, by type of injury and body region, the traumatic NBIs that required in-theater hospitalization in OEF in CY 2012.

- In 2012, 153 traumatic NBIs (coded in the 800-995 ICD-9-CM code series) required in-theater hospitalization.
- The most common types of injury leading to in-theater hospitalization were fractures (39 percent), open wound (12 percent), crushes (11 percent), and system-wide and late effects (11 percent).
- These injuries most often affected the lower extremity (24 percent), upper extremity (23 percent), and head/face/neck excluding TBI (14 percent).
- The most common hospitalized traumatic NBIs were fractures of the lower leg and/or ankle (11 percent), system wide and late effects (11 percent), crush injury of the wrist, hand, and/or fingers (7 percent), and internal Type 1 traumatic brain injuries (5 percent).

6.14 Frequency of Hospitalized NBI-related MSK Conditions by Type and Location of Injury

Table 6 categorizes, by type of injury and body region, the hospitalized NBI-related MSK conditions (a subset of MSK conditions coded in the 719-739 ICD-9-CM series) in CY 2012.

- In 2012, 29 NBI-related MSK conditions required in-theater hospitalization.
- The most common types of hospitalized injury-related MSK conditions were inflammation and pain (overuse) (48 percent), joint derangement (31 percent), and joint derangement with neurological involvement (17 percent).
- At 62 percent, the spine/back was the body region most affected by injury-related MSK conditions, followed by the lower extremity (24 percent), and upper extremity (14 percent).
- The leading specific NBI-related MSK conditions that were hospitalized were joint derangement to lower leg and knee (17 percent), inflammation and pain (overuse) involving the lumbar spine (14 percent), and joint derangement involving the lumbar spine (14 percent).

Table 3. Frequency of Air-evacuated Traumatic NBI by Type and Location of Injury, U.S. Army, OEF, CY 2012

			Fracture	Dislocation	Sprains/ Strains	Internal	Open Wound	Amputations	Blood Vessel	Contu- sion/Su- perficial	Crush	Burns	Nerves	Unspeci- fied	System- wide & late effects	Post- Concussive	Total	Percent	Percent by Body Region	
Head and Neck	Traumatic Brain Injury (TBI)	Type 1 TBI	1			11							0					12	2.2	4.6
		Type 2 TBI	2			6												8	1.5	
		Type 3 TBI	0															0	0.0	
		Additional DVBIC codes												4	0	1	5	0.9		
	Other Head, Face, Neck	Other head					1						0	0				1	0.2	2.4
		Face	6	0	0		2						1					9	1.7	
		Eye					2			0			0	0				2	0.4	
		Neck	0		0		0				0	0	1					1	0.2	
Head, Face, Neck Unspec.								0	0	0	0	0	0				0	0.0		
Spine and Back	Spinal Cord (SCI)	Cervical SCI	0			0												0	0.0	0.4
		Thoracic/Dorsal SC	1			0												1	0.2	
		Lumbar SCI	0			0												0	0.0	
		Sacrum Coccyx SC	0			0												0	0.0	
		Spine, Back Unspec	0			1												1	0.2	
	Vertebral Column (VCI)	Cervical VCI	2	0	2													4	0.7	3.3
		Thoracic/Dorsal VC	2	0	0													2	0.4	
		Lumbar VCI	6	0	4													10	1.9	
		Sacrum Coccyx VC	0	0	0													0	0.0	
		Spine, Back Unspec	2	0														2	0.4	
Torso	Torso	Chest (thorax)	2	0	0	1	0		0	0	0	0	0					3	0.6	2.4
		Abdomen				2	0		0	0		0	1					3	0.6	
		Pelvis, Urogenital	3	0	0	0	1		0	0	0	0	0					4	0.7	
		Trunk	0				0			0	0	0	0	1				1	0.2	
		Back, Buttock			2		0			0	0	0	0					2	0.4	
Extremities	Upper	Shoulder, Upper Arm	12	26	35		0	0		1	1	0		0				75	13.9	41.4
		Forearm, Elbow	16	3	1		3	0		0	0	0						23	4.3	
		Wrist, Hand, Fingers	70	3	6		14	9		2	10	0		6				120	22.0	
		Other & Unspec.	1				0	0	0	0	0	1	4	0				6	1.1	
	Lower	Hip	1	0	3					1	0							5	0.9	39.3
		Upper leg, Thigh	4					0		0	0	0						4	0.7	
		Knee	2	47	10					0	0	0						59	10.9	
		Lower leg, Ankle	79	1	15			0		0	1	0						96	17.8	
		Foot, toes	26	6	1		2	0		1	3	0						39	7.2	
Other & Unspec.		0		5		2	0	1	0	0	0		1				9	1.7		
Unclass. by Site	Other, Unspecified	Other/Multiple	0						0			0	0				0	0.0	4.1	
		Unspec. Site	10	0	7	0	0		0	1	0	4	0	0			22	4.1		
	System-wide & late effects																	12	2.2	100%
Total		248	86	91	21	27	9	1	6	15	6	6	12	12	1	541				
Percent		45.8	15.9	16.8	3.9	5.0	1.7	0.2	1.1	2.8	1.1	1.1	2.2	2.2	0.2		100%			

Note: ICD-9-CM 800-995 codes. Includes the first listed injury diagnosis for injuries resulting in out-of-CENTCOM air evacuation.

Table 4. Frequency of Air-evacuated NBI-related MSK Conditions by Type and Location of Injury, U.S. Army, OEF, CY 2012

			Inflammation and Pain (Overuse)	Joint Derangement	Joint Derangement with Neurological	Stress Fracture	Sprains/Strains/ Rupture	Dislocation	Total	Percent	Percent by Body Region
Spine and Back	Vertebral Column (VCI)	Cervical VCI	14	6	9				29	11.6	57.2
		Thoracic/Dorsal VCI		0	7				7	2.8	
		Lumbar VCI	89	10	1				100	40.0	
		Sacrum Coccyx VCI	0						0	0.0	
		Spine, Back Unspec. VCI	0	7	0	0			7	2.8	
Extremities	Upper	Shoulder	18	0			12	4	34	13.6	16.8
		Upper Arm, Elbow	0	1		0		0	1	0.4	
		Forearm, Wrist	0	0		0		0	0	0.0	
		Hand	2	0			5	0	7	2.8	
	Lower	Pelvis, Hip, Thigh	2	0		0	2	0	4	1.6	19.2
		Lower leg, Knee	8	11		1	12	1	33	13.2	
		Ankle, Foot	7	1		0	3	0	11	4.4	
Unclass. by Site	Other, Unspecified	Other specified/Multiple	2	0		0	0	0	2	0.8	6.8
		Unspecified Site	4	0	4	0	7	0	15	6.0	
		Total	146	36	21	1	41	5	250		
		Percent	58.4	14.4	8.4	0.4	16.4	2.0		100.0	100.0

Note: ICD-9-CM 710-739 codes. Includes the first listed injury diagnosis for injuries resulting in out-of-CENTCOM air evacuation.

Table 5. Frequency of Hospitalized Traumatic NBI by Type and Location of Injury, U.S. Army, OEF, CY 2012

			Fracture	Dislocation	Sprains/ Strains	Internal	Open Wound	Amputations	Blood Vessel	Contusion/ Superficial	Crush	Burns	Nerves	Unspecified	System- wide & late effects	Post- Concussive	Total	Percent	Percent by Body Region	
Head and Neck	Traumatic Brain Injury (TBI)	Type 1 TBI	5			7							0				12	7.8	11.1	
		Type 2 TBI	1			2											3	2.0		
		Type 3 TBI	0														0	0.0		
		Additional DVBIC codes											2	0	0		2	1.3		
	Other Head, Face, Neck	Other head					3						0	0				3	2.0	
		Face	6	0	0		4						1					11	7.2	
		Eye					2			2			0	0				4	2.6	
		Neck	0		0		1					0	0	0				1	0.7	
Head, Face, Neck Unspec.								0	2	0	1	0	0			3	2.0	14.4		
Spine and Back	Spinal Cord (SCI)	Cervical SCI	0			1											1	0.7	2.0	
		Thoracic/Dorsal SCI	1			0											1	0.7		
		Lumbar SCI	1			0											1	0.7		
		Sacrum Coccyx SCI	0			0											0	0.0		
		Spine, Back Unspec.	0			0											0	0.0		
	Vertebral Column (VCI)	Cervical VCI	4	0	0													4	2.6	5.2
		Thoracic/Dorsal VCI	1	0	0													1	0.7	
		Lumbar VCI	3	0	0												3	2.0		
		Sacrum Coccyx VCI	0	0	0												0	0.0		
		Spine, Back Unspec.	0	0													0	0.0		
Torso	Torso	Chest (thorax)	1	0	0	2	0		0	1	2	0	0				6	3.9	8.5	
		Abdomen				1	1		0	0			1	0			3	2.0		
		Pelvis, Urogenital	1	0	0	0	2		0	0	0	0	0	0			3	2.0		
		Trunk	0				0			0	0	0	0	0	1		1	0.7		
		Back, Buttock			0		0			0	0	0	0				0	0.0		
Extremities	Upper	Shoulder, Upper Arm	5	1	0		0	0		0	0	0		0			6	3.9	22.9	
		Forearm, Elbow	6	0	0		0	0		1	0	0					7	4.6		
		Wrist, Hand, Fingers	4	0	0		4	2		0	11	1		0			22	14.4		
		Other & Unspec.	0				0	0	0	0	0	0	0	0			0	0.0		
	Lower	Hip	0	0	1					0	0							1	0.7	23.5
		Upper leg, Thigh	1						0		0	0	0					1	0.7	
		Knee	1	2	1					0	0	0	0				4	2.6		
		Lower leg, Ankle	17	1	1			0		0	1	0					20	13.1		
		Foot, toes	2	1	0		0	0		0	3	0					6	3.9		
		Other & Unspec.	0		1		2	0		1	0	0	0		0		4	2.6		
Unclass. by Site	Other, Unspecified	Other/Multiple	0						0			0	0				0	0.0	1.3	
		Unspec. Site	0	1	1	0	0		0	0	0	0	0	0			2	1.3		
	System-wide & late effects		17																	17
		Total	60	6	5	13	19	2	1	6	17	4	0	3	17	0	153		100%	
		Percent	39.2	3.9	3.3	8.5	12.4	1.3	0.7	3.9	11.1	2.6	0.0	2.0	11.1	0.0		100%		

Note: ICD-9-CM 800-995 codes. Includes the first listed injury diagnosis for NBIs hospitalized in CENTCOM.

Table 6. Frequency of Hospitalized NBI-related MSK Conditions by Type and Location of Injury, U.S. Army, OEF, CY 2012

			Inflammation and Pain (Overuse)	Joint Derangement	Joint Derangement with Neurological	Stress Fracture	Sprains/Strains/ Rupture	Dislocation	Total	Percent	Percent by Body Region
Spine and Back	Vertebral Column (VCI)	Cervical VCI	3	0	2				5	17.2	62.1
		Thoracic/Dorsal VCI		0	3				3	10.3	
		Lumbar VCI	4	4	0				8	27.6	
		Sacrum Coccyx VCI	0						0	0.0	
		Spine, Back Unspec. VCI	2	0	0	0			2	6.9	
Extremities	Upper	Shoulder	2	0			0	0	2	6.9	13.8
		Upper Arm, Elbow	0	0		0		0	0	0.0	
		Forearm, Wrist	1	0		0		0	1	3.4	
		Hand	0	0			1	0	1	3.4	
	Lower	Pelvis, Hip, Thigh	0	0		0	0	0	0	0.0	24.1
		Lower leg, Knee	2	5		0	0	0	7	24.1	
		Ankle, Foot	0	0		0	0	0	0	0.0	
Unclass. by Site	Other, Unspecified	Other specified/Multiple	0	0		0	0	0	0	0.0	0.0
		Unspecified Site	0	0	0	0	0	0	0	0.0	
		Total	14	9	5	0	1	0	29		
		Percent	48.3	31.0	17.2	0.0	3.4	0.0		100.0	100.0

Note: ICD-9-CM 710-739 codes. Includes the first listed injury diagnosis for injuries resulting in in-CENTCOM hospitalization.

7 Discussion and Recommendations

7.1 Discussion

In CY 2012, NBI was the largest single diagnosis category that resulted in out-of-CENTCOM air evacuations for OEF and the second leading category for OEF hospitalizations. BI was the leading diagnosis category for OEF hospitalizations. The present findings are consistent with previous reports showing the relative importance of NBIs as a cause of morbidity and mortality (references 1-10) .

- In the CY 2011 deployment injury surveillance report, for OEF there were nearly three times more air evacuated disease and non-battle injuries (DNBIs) (NBI: n=1002; Disease: n=1637) combined, than BIs (n=931)¹⁵. If we look at NBIs alone, they comprised 28 percent of air evacuations, higher than BIs (26 percent) (reference 15).
- Similarly in 2012 for OEF, there were three times as many air evacuated DNBIs (NBI: n=885; Disease: n=1602) than BIs (n=760), and 27 percent of air evacuations were NBIs.
- For hospitalized NBIs and BIs, the proportions decreased from 2011 in OEF. The decrease is greater for NBIs than BIs from 2011 to 2012. NBIs decreased by 13 percent while BIs decreased by 9 percent (reference 15).

For both BI and NBI, OEF has experienced greater fluctuations in the rates of air evacuations and hospitalizations than deaths from 2003-2012. Injury rates and trends for OEF were previously reported by other descriptive studies (references 16-18). However, unlike figures 3 and 4, these studies did not include the 2007 time period when looking at peak rates throughout the years.

- The trend in OEF decreased for air evacuations, hospitalizations, and deaths in 2012 compared to 2011. BI hospitalizations had the biggest differential decrease going from 12.4 to 6.5 per 1,000 person-years (48 percent). Within NBIs, air evacuations decreased from 14.2 to 11.1 per 1,000 person-years (22 percent).
- From 2011 to 2012 there was a decrease in rate of OEF BI deaths from 3.8 to 2.2 per 1,000 person-years. Even though there was a decrease, the leading causes of OEF battle-related deaths were similar. An increase in the proportion of BI deaths caused by gunshot wounds was noted, increasing from 26 percent to 34 percent.

In this report for OEF, the leading types of traumatic air evacuated NBIs were fracture (n=247; 46 percent), sprain/strain (n=91; 17 percent), and dislocation (n=86; 16 percent). The leading type of NBI-related MSK condition was pain and inflammation (overuse) (n=146; 58 percent of these conditions). These leading injury types have been consistent for several years (references 5 and 8-10). The finding of fractures as the leading NBI types for both hospitalizations and air evacuations was consistent with the burden of non-battle orthopedic injuries treated at one facility during the combat phase of OIF (reference 19).

In general, previous studies have focused on specific body regions or diagnosis categories when describing injury or disease types. This investigation described all body regions affected for each injury type.

- Whereas the upper extremity and lower extremity account for most of the traumatic injury air evacuated NBIs (41 and 39 percent, respectively), the spine and back account for the majority of air evacuated NBI-related MSK conditions (57 percent).
- The leading body sites for injury did not differ for 2012 when compared to 2011. In 2012, the leading body injury sites for hospitalized NBIs, in order of high to low, were the wrist/hand/fingers, lower leg/ ankle and system-wide/late effects.
- Like the air evacuated NBI-related MSK conditions, spine and back (62 percent) also account for the majority of hospitalized NBI-related MSK conditions.

The U.S. Army uses surveillance data to identify causes of injury and potentially modifiable risk factors for injury to develop comprehensive injury prevention programs. This report has identified the top three causes of NBI air evacuations in 2012 as sports/physical training, falls/jumps, and crushing/blunt trauma. The top three leading causes of NBI hospitalizations were falls/jumps, crushing/blunt trauma, and land transport-related accidents. The leading causes of fatal NBIs were weapons-related incidents (gunshot wounds), land transport-related accidents, air transport-related accidents, and inhalation or ingestion of toxic substances. Self-inflicted injuries, which had risen from 2004 to 2008 (reference 20), accounted for 51 percent of fatal NBIs. All of these self-inflicted deaths were weapons-related.

- When comparing the leading causes of OEF NBIs from 2011 to 2012, they show similar results. Air evacuated sports/physical training injuries (21 percent) went from being the second to the first leading cause. Hospitalized fall/jump injuries (17 percent) stayed as the leading NBI cause from 2011-2012. The leading cause of NBI deaths also stayed the same, weapons-related incidents (62 percent). The weapons-related death numbers for OEF increased from 11 to 23 from 2011 to 2012.
- In 2011 there were no deaths caused by aircraft crash; however there were four fatalities in 2012.

Current intervention studies and strategies (civilian and military) to address deployment NBI include:

- Vehicle rollover drowning prevention training, rollover simulator training, equipment modifications to prevent rollover accidents, and improved compliance for seatbelt use (references 21-23).
- Boarding and alighting of land and air transport training to reduce fall and jump injuries.
- Ocular preventive measures such as hygiene, contact lens restriction, and protective eyewear use during participation in racquet and contact sports (references 24-27).
- Use of ankle braces (stabilizers) to reduce ankle injuries (references 29-30).
- Breakaway bases, recessed bases, and proper sliding technique education for softball and baseball sliding injuries (reference 31).
- Mouth guard use in sports activities where there is significant risk of orofacial injury (reference 32).

7.2 Recommendations

Continue routine surveillance of deployment injuries and annual updates of this deployment injury surveillance report.

Link additional data sources, such as levels IV and V hospitalizations and disability records, to provide an enhanced description of deployment injuries and their outcomes.

Continue investigations to identify potentially modifiable risk factors that contribute to the leading causes of injury.

Focus attention on strategies that will aid in preventing injuries from sports/physical training, falls/jumps, and land transport accidents.

- Make sure surfaces for sports are level and free of hazards.
- Avoid overtraining.
- Be cautious when getting on and off vehicles and working around them to avoid falls.
- Wear seatbelts when tactical situation permits.

8 Results—Special Analytic Deployment Injury Surveillance Project Summaries, 2012

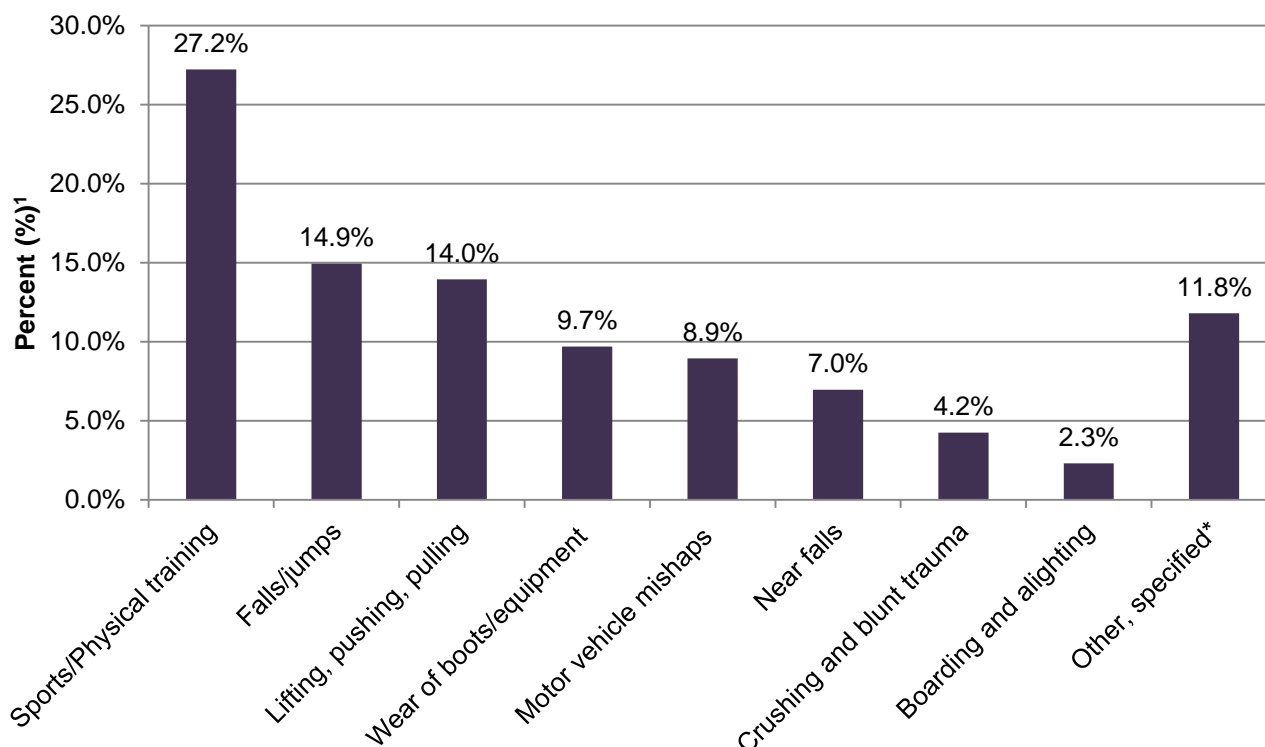
8.1 Air Evacuated NBIs Diagnosed as Sport Related MSK Conditions, U.S. Army 2001-2010 (Poster - Annual Meeting of the American College of Sports Medicine)

Sports and Exercise were leading causes (23 percent) of NBIs requiring medical air evacuation from ongoing military operations in Iraq and Afghanistan from 2001 to 2010.

Since injury-related MSK conditions are not routinely monitored, it is difficult to ascertain their impact on lost duty days, operational readiness, and Soldier quality of life. Therefore, it is crucial to examine the incidence, rates, and causes of sports-related MSK injuries requiring air evacuation of deployed Army soldiers from Iraq or Afghanistan.

Of the 7,304 NBI-related MSK conditions that were air evacuated, 50 percent (n=3,671) had an identified cause of injury. The leading identified causes of MSK conditions were sports and exercise (n=998), falls/jumps (n=548), and lifting/pushing/pulling injuries (n=513) (Figure 9).

Figure 1. Distribution of causes of musculoskeletal non-battle injuries air evacuated from Iraq and Afghanistan (2001-2010).



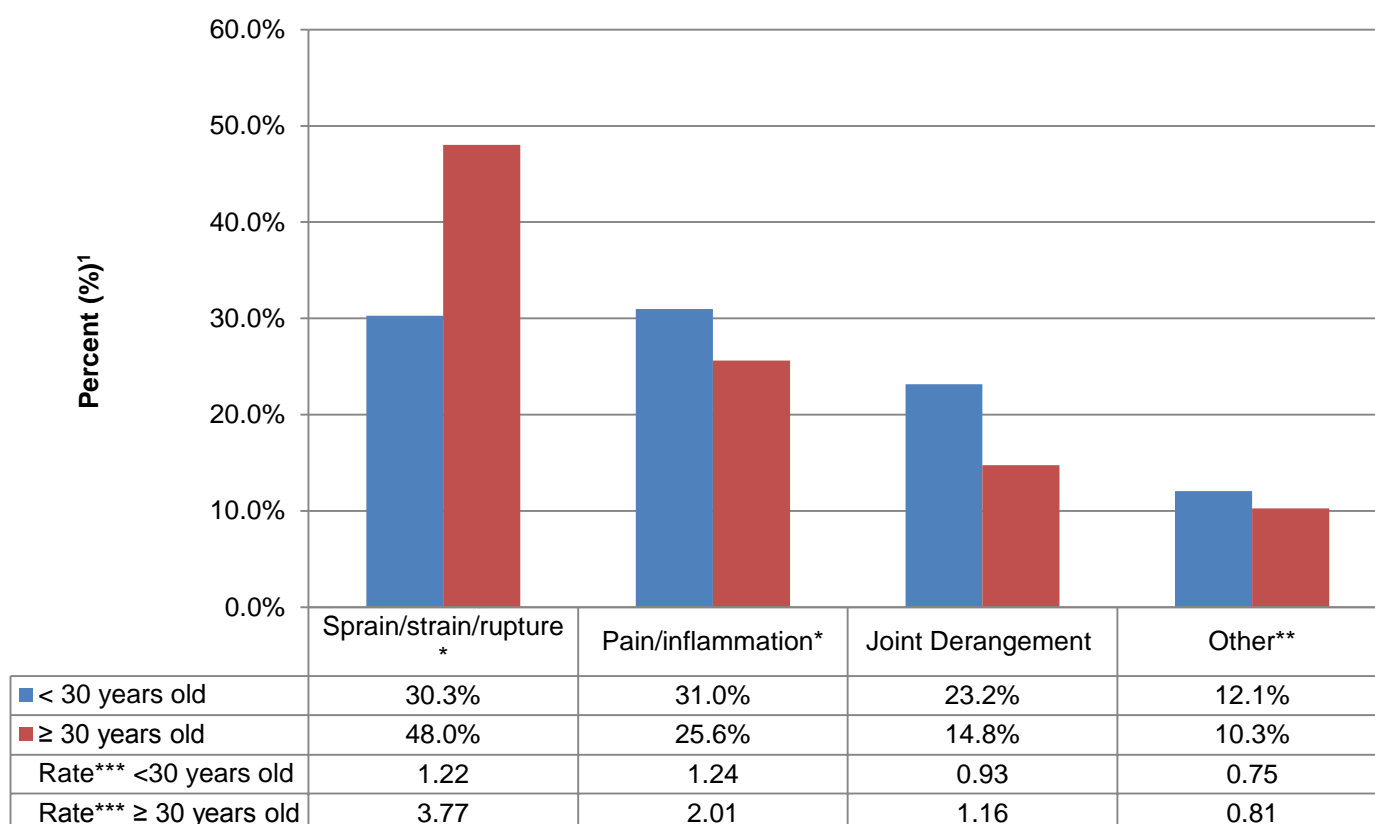
Musculoskeletal Non-battle Injury Causes

Note: ¹Percent of air evacuated injury-related musculoskeletal conditions with identified causes (n=3,671)

*Other, specified includes cutting and piercing (n=24), environmental factors (n=11), handling weapons/explosives (n=5), and other specified agents (n=394)

Figure 9. Distribution of Causes of NBI-related MSK Conditions Air Evacuated from Iraq and Afghanistan (2001-2010)

The leading nature of injury for the sport and exercise-related MSK conditions included sprain/strain/rupture (39 percent), pain/inflammation (28 percent), and joint derangement (19 percent). Soldiers in the 30+ year age group had a significantly greater rate of sprain/strain/rupture ($p<.01$) and pain/inflammation ($p<.01$) injuries (Figure 10).



Note: ¹Percent of air evacuated injury-related musculoskeletal conditions (n=7,304).

*Indicates significant differences between injury rates between age groups at the p< 0.05 level.

**Other includes remaining body regions that accounted for ≤ 1% of injury-related musculoskeletal conditions per site.

***Rate per 10,000 Soldier-years

Figure 10. Leading Injury Types for Sport and Exercise-related MSK Conditions, Iraq and Afghanistan (2001-2010)

8.2 Sports Injuries Among U.S. Army Soldiers Deployed to Iraq and Afghanistan, 2001-2010 (Poster - Annual Meeting of the American College of Sports Medicine)

- Even in a dangerous combat environment, sports and exercise are an important cause on non-fatal injuries. Overall, 19,595 Soldiers were air evacuated for NBIs from 2001-2010. Sports and exercise were the leading causes, comprising 23 percent of NBIs.

- Figure 11 shows the annual rates of sports and PT-related injuries increased in Iraq until it peaked in 2009 (at almost 40 injuries per 10,000 deployed Soldier-years). The annual rates for Afghanistan however, fluctuated over time, starting at 32 injuries per 10,000 deployed Soldier-years, peaking at 36 injuries per 10,000 deployed Soldier-years in 2007, and ending at 28 injuries per 10,000 deployed Soldier-years.
- As shown in Table 7, sprain/strain/rupture was the leading injuries for all sports and PT activities except for American football. Fracture was the leading injury type for American football.

Figure 11. Annual Rate of Air Evacuated Sports and Physical Training Injuries for Deployed Soldiers, 2001-2010

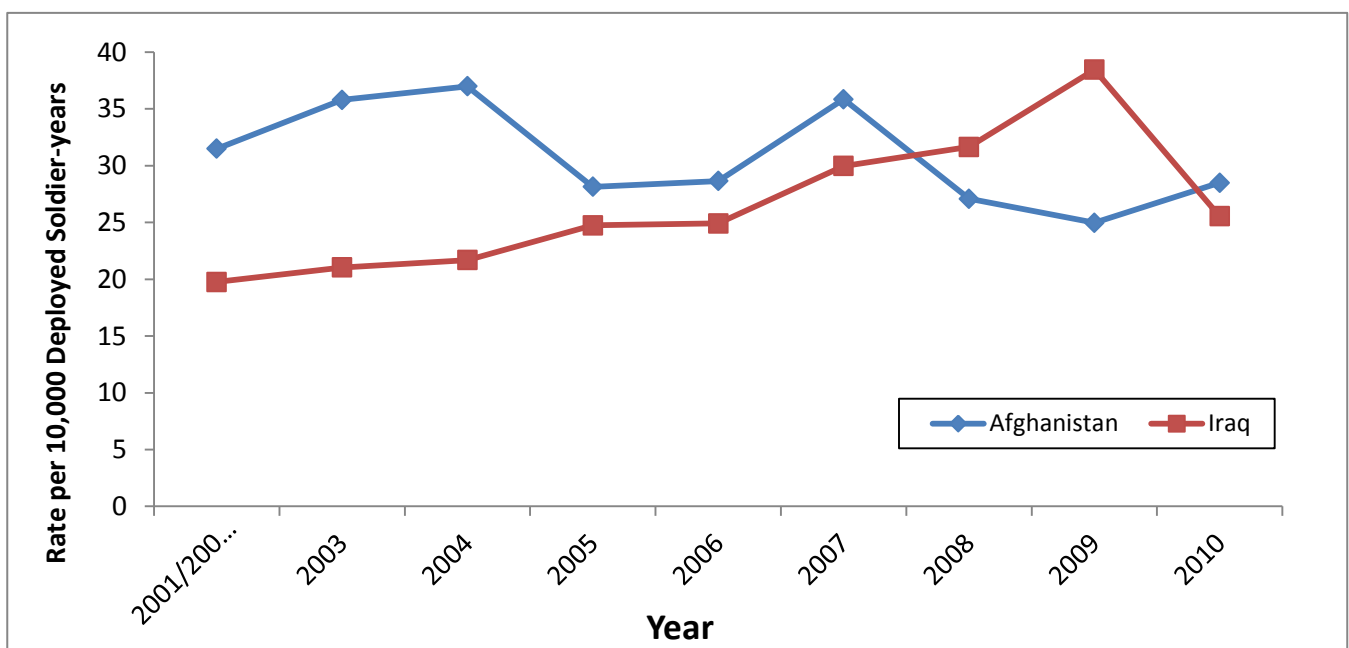


Table 7. Distribution of the Four Common Injury Types for the Four Most Common Sports/PT Activities (Basketball, Physical Training, American Football, and Weight Lifting)

Leading Injury Type by Sport	Frequency (N)	Percent of Sport Total (%)
Basketball (n=752)		
Sprain/Strain/Rupture	275	36.57
Fractures	175	23.27
Dislocations	172	22.87
Pain/Inflammation	28	3.72
Physical Training (n=584)		
Sprain/Strain/Rupture	115	15.29
Pain/Inflammation	101	13.43
Fractures	91	12.10
Dislocations	91	12.10
American Football (n=519)		
Fractures	207	27.53
Sprain/Strain/Rupture	100	13.30
Dislocations	92	12.23
Other derangement/Joint	27	3.59
Weight Lifting (n=473)		
Sprain/Strain/Rupture	182	24.20
Pain/Inflammation	76	10.11
Dislocations	38	5.05
Other derangement/Joint	35	4.65

8.3 Request for Information: Injuries from Load Carriage_(Congressional Request)

Data on MSK injuries as a result of Soldier load was summarized for a Congressional request. There has been concern since the beginning of OEF and OIF about the possible association of MSK injury with 1) the heavy combat load Soldiers carry and 2) IBA worn by Soldiers.

In Figure 12, the back accounted for 17 percent of the injuries and was the leading anatomic location of injury, followed by the knee (15 percent), wrist/hand (13 percent), ankle/foot (12 percent), and shoulder (10 percent).

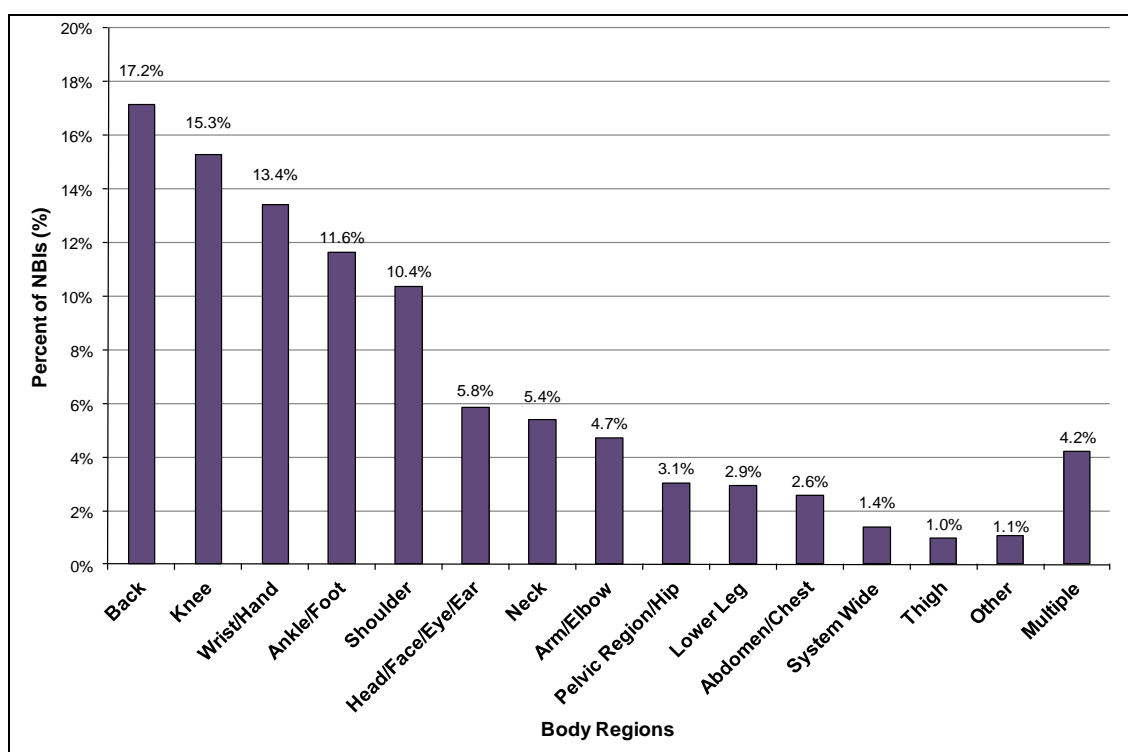


Figure 12. Anatomic Distribution for Air Evacuated NBI: Iraq and Afghanistan, 2001- 2011

Injuries related to combat load carriage or wear of the IBA would most commonly be overuse injuries. Overuse injuries of the back comprised 53 percent of NBIs in Iraq and 49 percent in Afghanistan.

In Table 8, the leading causes of back injuries that required air evacuation were injuries that occurred prior to deployment but were exacerbated during the deployment (18 percent), lifting/pushing/pulling (11 percent), falls (9 percent), motor vehicle accidents (9 percent), sports/PT (5 percent), and wearing body armor (3 percent).

Table 8. Causes of Air Evacuated Back Injuries (NBI) Iraq and Afghanistan 2001-2011

Causes of Injury	Frequency (n)	Percent (%)
History of prior injury	660	18.2
Lifting/pushing/pulling	387	10.7
Falls/jumps	336	9.3
Motor vehicle accident	317	8.8
Sports/PT	187	5.2
Wearing body armor	118	3.3
Crushing/blunt trauma	49	1.4
Other specified	271	7.5
Unspecified	1297	35.8
Total	3,622	100

9 Conclusions and Recommendations for Commanders

9.1 Conclusions

Sports and exercise-related MSK injury prevention programs should focus on the leading causes (physical training, weight lifting, and basketball) and must receive adequate resources to develop evidence-based prevention strategies.

Participation in sports and PT during deployment is encouraged. However, these activities can result in injuries that limit Soldiers from performing their duty, which results in decreased military performance. Prevention strategies should be a priority to lessen the impact of injuries. Researchers have described the physiologic effects of load carriage and wearing IBA. These include decreases in endurance, strength, balance, and functional field test performance. These physiologic effects may contribute to a higher injury risk for Soldiers carrying heavy loads or wearing IBA. Injuries related to combat load carriage or wearing of the IBA tend to be overuse injuries. Overuse injuries of the back comprised 49 percent of NBIs in OEF.

9.2 Recommendations

Use evidence-based countermeasures and safety guidelines to lower the injury risk (reference 33).

Leaders and Soldiers should use composite risk management to identify hazards and control risks across all Army missions and activities.

Timely and accurate reporting is critical any time an accident occurs. It is imperative that all accidents are investigated and reported.

Focus attention of strategies that will aid in preventing injuries from leading causes of injury.

- To prevent sports and physical training injuries:
 - Avoid training too hard or too long when beginning or changing activities.
 - Gradually increase how often and how long you train after a break in training due to leave, illness, or redeployment.
- To prevent motor-vehicle related injuries:
 - Use ground guides to ensure vehicles are not traveling too fast for high risk or heavily populated areas. Train all personnel when to use ground guides and how to execute ground-guiding procedures.
 - Secure personnel and cargo – seat belts and gunner restraints save lives and prevent injury.
 - Rehearse rollover, emergency egress and rescue drills prior to each mission.
 - Establish and enforce safe speed limits for the road and environment.
- To prevent fall-related injuries:
 - Inspect the facilities on the operating base to identify and remove hazards that may lead to slips, trips, and falls indoors and outdoors.
 - Remove trip hazards from sidelines of basketball courts and sport fields.
 - When feasible, ensure personnel use fall protection when working at heights.
 - Conduct spot checks to ensure appropriate guards and barriers are in place.

10 Point of Contact

The point of contact at USAPHC is the Epidemiology and Disease Surveillance Portfolio, Injury Prevention Program, commercial 410-436-4655 or DSN 584-4655. Inquiries may also be submitted electronically at usarmy.apg.medcom-phc.mbx.injuryprevention@mail.mil.

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Appendix A

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Appendix B

Barell Injury Diagnosis Matrix and Associated ICD-9-cm 800-995 Codes

		ICD-9-CM codes		FRACTURE		DISLOCATION		SPRAIN & STRAIN		INTERNAL		OPEN WOUND		AMPUTATION		BLOOD		CONTUSION / SUPERFICIAL		CRUSH		EDRUS		NERVE		UNSPECIFIED	
				200-229		220-229		240-249		260-269, 280-289		270-274, 280-284		226-227, 228-229		280-284		210-214		226-229		240-249		260-269		280-289	
ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM	ICD-9-CM
Major and minor	1	Type 1 Dist	200.201, 200.204, 1-4, 5-9, (103-05, 53-55)	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9	200.201, 200.204, 1-4, 5-9
	2	Type 2 Dist	200.201, 200.204, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 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Appendix C

Injury-Related Musculoskeletal Condition Matrix and Associated ICD-9-CM 710-739 Codes

Injury Location			Inflammation and Pain (Overuse)	Joint Derangement	Joint Derangement with Neurological Involvement	Stress Fracture	Sprains/Strains/Rupture	Dislocation
	Vertebral Column	Cervical	723.1	722.0	722.71, 723.4			
		Thoracic/Dorsal		722.11	722.72, 724.4			
		Lumbar	724.2	722.10	722.73, 724.3			
		Sacrum, Coccyx	720.2					
		Spine, Back Unspecified	721.7, 724.5	722.2	722.70, 724.9	733.13		
Extremities	Upper	Shoulder	716.11, 719(.01,.11,.41), 726(.0,.1,.2)	718(.01,.11,.81,.91)			727(.61-.62)	718.31
		Upper arm, Elbow	716.12, 719(.02,.12,.42), 726.3	718(.02,.12,.82,.92)		733.11		718.32
		Forearm, Wrist	716.13, 719(.03,.13,.43), 726.4	718(.03,.13,.83,.93)		733.12		718.33
		Hand	716.14, 719(.04,.14,.44)	718(.04,.14,.84,.94)			727(.63-.64)	718.34
	Lower	Pelvis, Hip, Thigh	716.15, 719 (.05,.15,.45), 726.5	718(.05,.15,.85,.95)		733(.14-.15)	727.65	718.35
		Knee, Lower leg	716.16, 717.7, 719(.06,.16,.46), 726.6	717(.0-.6,.9), 718(.06,.16,.86,.96)		733(.16,.93)	717.8, 727(.66-.67)	718.36
		Ankle, Foot	716.17, 719(.07,.17,.47), 726.7, 728.71, 734	718(.07,.17,.87,.97)		733.94	727.68	718.37
Unclassified by Site	Others and Unspecified	Other specified/Multiple	716(.18-.19), 719(.08-.09,.18-.19,.48-.49), 726.8, 727.2	718(.08,.09,.18,.19,.88,.89,.98,.99)		733.19	727.69	718(.38,.39)
		Unspecified Site	716.10, 719(.00,.10,.40), 726.9, 727.3, 729.1	718(.00,.10,.80,.90)	729.2	733(.10,.95)	727.60, 728.83	718.30